

What is Claimed is;

1. A battery pack malfunction detection apparatus that detects a malfunction in a battery pack constituted with a plurality of chargeable/dischargeable cells, comprising:

5 malfunction detection devices each provided in correspondence to a predetermined number of cells to detect an overcharge malfunction in the corresponding predetermined number of cells during an overcharge detection period and to detect an over-discharge malfunction in the corresponding  
10 predetermined number of cells during an over-discharge detection period; and

a decision-making device that makes a decision as to whether or not a cell in an overcharge malfunction state or a cell in an over-discharge malfunction state exists based  
15 upon a signal input from each of the malfunction detection devices, wherein:

each of the malfunction detection devices outputs a first signal if an overcharge malfunction is detected in any of the corresponding predetermined number of cells and outputs a  
20 second signal if no overcharge malfunction is detected during the overcharge detection period, outputs the second signal if an over-discharge malfunction is detected in any of the corresponding predetermined number of cells and outputs the first signal if no over-discharge malfunction is detected  
25 during the over-discharge detection period, and alternately

outputs the output signal during the overcharge detection period and the output signal during the over-discharge detection period to the decision-making device through time sharing.

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2. A battery pack malfunction detection apparatus according to claim 1, wherein:

the decision-making device decides that there is a cell with an overcharge malfunction if the first signal is input from the malfunction detection device both during the overcharge detection period and during the over-discharge detection period.

3. A battery pack malfunction detection apparatus according to claim 1, wherein:

the decision-making device decides that there is a cell with an over-discharge malfunction if the second signal is input from the malfunction detection device both during the overcharge detection period and during the over-discharge detection period.

4. A battery pack malfunction detection apparatus according to claim 1, wherein:

each of the malfunction detection devices includes a voltage comparator that compares a terminal voltage at each

of the corresponding predetermined number of cells with a reference voltage, outputs the first signal if the terminal voltage at any cell is higher than the reference voltage by using an overcharge decision-making voltage as the reference voltage during the overcharge detection period and outputs the second signal if the terminal voltage at any cell is lower than the reference voltage by using an over-discharge decision-making voltage as the reference voltage during the over-discharge detection period.

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5. A battery pack malfunction detection apparatus according to claim 1, further comprising:

a clock generation device that generates a clock signal, wherein:

15 each of the malfunction detection devices switches between an overcharge malfunction detection and an over-discharge malfunction detection based upon the clock signal generated by the clock generation device.

20 6. A battery pack malfunction detection apparatus according to claim 1, wherein:

the overcharge malfunction detection period and the over-discharge malfunction detection period extend over lengths of time different from each other.

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7. A battery pack malfunction detection apparatus according to claim 1, wherein:

if a current consumed in the battery pack malfunction detection apparatus when the malfunction detection devices output a signal indicating that none of the corresponding predetermined number of cells is in an overcharged state is different from a current consumed in the battery pack malfunction detection apparatus when the malfunction detection devices output a signal indicating that none of the corresponding predetermined number of cells is in an over-discharged state, the signal requiring a larger current consumption is output over a smaller length of time than the signal requiring a smaller current consumption.

8. A battery pack malfunction detection apparatus that detects a malfunction in a battery pack constituted with a plurality of chargeable/dischargeable cells, comprising:

a plurality of malfunction detection means, each provided in correspondence to a predetermined number of cells, for detecting an overcharge malfunction in the corresponding predetermined number of cells during an overcharge detection period and an over-discharge malfunction in the corresponding predetermined number of cells during an over-discharge detection period; and

a decision-making means for making a decision as to

whether or not a cell in an overcharge malfunction state or a cell in an over-discharge malfunction state exists based upon a signal input from the malfunction detection means, wherein:

5           each of the plurality of the malfunction detection means outputs a first signal if an overcharge malfunction is detected in any of the corresponding predetermined number of cells and outputs a second signal if no overcharge malfunction is detected during the overcharge detection period, outputs the  
10   second signal if an over-discharge malfunction is detected in any of the corresponding predetermined number of cells and outputs the first signal if no over-discharge malfunction is detected during the over-discharge detection period, and alternately outputs the output signal during the overcharge  
15   detection period and the output signal during the over-discharge detection period to the decision-making means through time sharing.

9.       A battery pack malfunction detection method for  
20   detecting a malfunction in a battery pack constituted with a plurality of chargeable/dischargeable cells comprising:  
          generating a first signal upon detecting an overcharge malfunction in any of the cells and a second signal if no overcharge malfunction is detected during an overcharge  
25   detection period;

generating the second signal upon detecting an over-discharge malfunction in any of the cells and the first signal if no over-discharge malfunction is detected during an over-discharge detection period;

5           outputting the signal generated during the overcharge detection period and the signal generated during the over-discharge detection period alternately through time sharing; and

          making a decision as to whether or not there is a cell  
10   manifesting an overcharge malfunction or an over-discharge malfunction based upon the signal output through time sharing.